Photoluminescence and Raman spectroscopy of highly ordered organic semiconductor structures

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Stellingen

behorende bij het proefschrift

Photoluminescence and Raman Spectroscopy of Highly Ordered Organic Semiconductor Structures

door Artur Mannanov

1. The polymer cold crystallization dynamics on a sub-minute timescale in the polycrystalline active layers of P3HT-fullerene solar cells can be tracked on-the-fly by a non-destructive spectroscopic tool: Real-time Raman spectroscopy (Chapter 2).
2. The energy transfer within molecularly doped organic crystals of thiophene-phenylene co-oligomers and furan-phenylene co-oligomers is mediated by both excitonic transport in the host and host-dopant Förster resonant energy transfer with the averaged energy transport length from 2.5 to 25 nm (Chapter 3, 4).
3. Monte-Carlo modelling of the photoluminescence time-resolved spectra recorded for variously molecularly doped crystals reveals the interplay between exciton diffusion in the host material and Förster resonant energy transfer to the dopant (Chapter 3, 4).
4. Exciton harvesting in organic crystals on dopants at tens of ppm doping levels is readily achieved via long-range exciton diffusion, as demonstrated in furan-phenylene co-oligomer crystals (Chapter 4).
5. In the thiophene-phenylene co-oligomer crystals with the face-on molecular orientation with respect to the largest crystal face, the highest photoluminescence efficiency is unexpectedly observed for the excitation polarization orthogonally to the transition dipole moments of the molecules. This highly surprising feature is explained by the presence of non-radiative states responsible for photoluminescence quenching (Chapter 5).
6. Photoluminescence in highly crystalline organic monolayers indicates less efficient non-radiative transitions with respect to those of bulk amorphous/polycrystalline structures prepared from the same molecules, as demonstrated in films based on thiophene-phenylene co-oligomers (Chapter 6).
7. It does not matter how many experiments you had accomplished until you performed the right one.
8. To compose a scientific sentence, keeping in mind the previous and next ones is not enough. The whole coherent story should be considered.
9. A “sandwich” PhD student is like an electron in a π-conjugated polymer chain: highly delocalized.